Doflein is inclined to accept the evidence that Schaudinn's account of *Entamœba histolytica* is based in part upon phenomena attendant upon processes of degeneration and suggests that Viereck's *E. tetragena* is probably the most widespread form causing amœbic dysentery, and that the two are possibly identical, but that the organism according to the rigid laws of priority should be called *Entamœba dysenteriæ* (Councilman and Lafleur).

The doubtful group Chlamydozoa established by Prowazek for that group of immunizing organisms with a filterable virus, the supposed etiological factors in such diseases as vaccinia, variola, trachoma, molluscum contagiosum and epithelioma contagiosum, is still denied admittance by the author to the Protozoa on the ground that the minute structures described by Prowazek are not themselves with certainty proved to be living organisms. Doflein admits, however, that the evidence is constantly increasing that we have to do in the case of these diseases with parasitic organisms, but thinks they may be more closely related to the bacteria than to the protozoa.

It is a matter of regret that the non-parasitic groups, such, for example, as the pelagic Foraminifera and Radiolaria, and non-parasitic flagellates can not receive in a work of this sort commensurate treatment with pathogenic forms of confessedly great biological, as well as medical and hygienic interest. The author expresses the hope that medical research may in the near future so clear up contested points that less space will be required for the discussion of pathogenic forms. The present output is, however, not very promising for a reduction in extent in this field. The fact is that a six-volume edition of the Protozoa in Bronn's "Thiereich" is needed to give anything like an adequate review of the results now achieved in the fields of Protozoology.

CHARLES ATWOOD KOFOID

UNIVERSITY OF CALIFORNIA

HEREDITY

H. M. Leake[14] gives additional results of his studies of inheritance in cotton. The flower color factors found were yellow, pale yellow and red, the latter being due to red sap color which showed not only in the flowers but in stems and leaves as well.

[14] "Studies in Indian Cotton," *Jour. of Gen.*, Aug., 1911.

Yellow was completely dominant to its absence and to pale yellow. Red was incompletely dominant. The very interesting fact developed that although yellow behaved as an allelomorph to its absence in crosses with white, it was also allelomorphic to pale yellow in crosses with the latter. This indicates that pale yellow is simply a modified form of yellow, a fact in entire accord with my teleone theory of Mendelian inheritance, and opposed to the de Vriesian idea of the immutability of the so-called unit characters. An interesting case of correlation was found. White (absence of yellow) is hardier than yellow.

In shape of leaf Leake uses as an empirical means of describing leaf shape a formula which is essentially the ratio between the length and breadth of the central lobe. The pure races (and the author took the pains to work with pure races) may be divided into two groups with reference to this "leaf factor," namely those in which it is less than 2, and those in which it is greater than 3. No cases were found in pure races in which the value of this factor was between 2 and 3. F_1 between these groups gave intermediate leaf factors. F_2 apparently behaved as if the cross involved a single gene, but fluctuating variation obscured the results considerably. Crosses between F_1 and either parent form gave only the intermediate and the one parent form, the same difficulty appearing from fluctuation in the character. This strongly confirms the conclusion that a single gene is responsible for the difference between these two groups.

Earliness of flowering $\times$ late flowering proved to be a very interesting study. The author had previously discovered that types with sympodial secondary branches flower early, while those having monopodial secondaries are late flowering. This relation had also been noticed by others, the early or late flowering being a result of the manner of branching. Length of vegetative period (time between planting and first flower) proved to be highly fluctuating, varying widely as between different seasons. F_1 between the monopodial and the sympodial types was intermediate between the parents, but nearer the sympodial (early) parent. F_2 gave a continuous series extending from the early parent nearly to the late parent, the frequency curve for the earliness in the F_2 population being monomodal. While the author does not pursue the subject further, it may easily be shown that this is exactly what Mendelian theory calls for on the assumption that several factors, each alike in effect, their

effects being additive, are responsible for the parental differences, especially when the character in question fluctuates widely as compared with the differences between the several genotypes occurring in F_2. Thus, suppose three factors, *A*, *B* and *C*, each alike in effect, and each producing the same average increase in length of vegetative period. The F_2 generation of the cross *abc* $\times$ *ABC* will consist of the genotypes *aabbcc, aabbCC, aaBBcc, AAbbcc, aaBBCC, AAbbCC, AABBcc* and *AABBCC* and their crosses. The genotype *aabbcc* would be similar to the early parent. Genotypes *AAbbcc, aaBBcc* and *aabbCC* would constitute a group one stage later in flowering. *AABBcc, AAbbCC* and *aaBBCC* constitute a third stage, while *AABBCC* would be equivalent to the late parent. Thus the four stages resulting from these three factors tend to be present in the ratio 1 : 3 : 3 : 1, which ratio is merely one way of stating the properties of an ordinary frequency curve. Earliness being nearly completely dominant, the norm of this curve would be shifted toward the early parent, as Leake found was the case. Even if this progeny were selfed to the tenth generation, by which time heterozygosis would have largely disappeared, the mixture of the four genotypes would still give a monomodal curve. The only exception to this would be cases in which fluctuating variation is not transgressive between the genotypes. It is possible that more than three genes were involved in Leake's crosses.

Crosses between pure lines having no leaf glands and those having leaf glands gave intermediate F_1. F_2 gave evidence of segregation, but the intermediate and apparently highly fluctuating character of the heterozygotes rendered positive conclusions difficult or impracticable.

Complete correlation occurred between flower color and length of petals. White petals were little if any longer than the bracteoles, while yellow petals were about twice as long. Intermediates did not occur, and no exceptions were found in over 100,000 plants.

Red sap color was independent of the size of the petal but when present it lengthened the vegetative period. This paper is exceedingly clear and lucid in treatment, and we may expect much valuable work from the author in future.

Dr. Shull has resumed his interesting studies of *Bursa*.[15] He

[15] Dr. G. H. Shull, "Defective Inheritance-Ratios in *Bursa* Hybrids," *Verh. d. Naturforsch.* Ver. in Brünn., Bd. XLIX.

had previously shown that four genotypes of *Bursa bursa-pastoris* are the four Mendelian types corresponding to two independent factors (*AABB, AAbb, aaBB, aabb*). In his paper above cited he deals with a cross between one of these types (*aabb*) with a genotype of *Bursa Heegeri* corresponding to the type *AABB*. The factors *A* and *B* in this cross behave in the usual Mendelian fashion, departures from expected ratios being explained by variation in dominance in one of the families. But the factor or factors governing differences in the seed pod of these two species present departures from expected ratios that are not fully understood. There is evidence that at least two genes are concerned in this difference. If only one gene were concerned the ratio between the two types of seed capsule in F_2 should be 3:1; if there are two genes, the ratio should be 15:1, three genes, 63:1. The ratios observed in F_3 were 4.67:1 (instead of 3:1), 15.6:1, 24:1 and 63.5:1. The latter ratio, obtained in a rather large family (129 individuals), suggests three genes. The first and fourth of the above ratios are rather wide departures from expected ratios, and their meaning is not yet clear. The matter is still under investigation. There seems to be little doubt that Dr. Shull has added another case to the interesting class of Mendelian characters that may be represented by more than one independent gene, such as those found by Nillson-Ehle, in oats and wheat and by East in corn.

A very interesting paper by Gortner,[16] giving further results of his studies on melanin formation, appeared in the December (1911) number of this journal. He was able to show the color pattern in the Colorado potato beetle is due to the fact that the chromogen is secreted only in certain spots, while the oxidizing enzyme, which is of the tyrosinase type, is present generally in the elytron.

W. J. SPILLMAN

[16] Dr. R. A. Gortner, "Studies on Melanin," AMER. NAT., Vol. XLV, No. 540, pp. 743 et seq.